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ABSTRACT

Words were used as the stimulus factors to test the two-stage reading process. The first stage is a decoding stage in which the words are perceived and translated into an acoustic code, and the second stage is a semantic matching stage in which words were categorized into three phonological factors (word length, vowel complexity, and regularity) affecting only the decoding stage and two semantic component factors (word familiarity and concreteness) expected to affect the semantic matching stage only. An experimental session consisted of 6 blocks, 96 words altogether. Each block had two phases, a prefamiliarization or training phase followed by a test phase. Experiment 1, using second and fifth grade children, showed pictures and words; experiment 2, using first and third grade children, varied the sentences that were read and the amount of pronunciation practice. Results indicated that the phonological prefamiliarization and word factors affected decoding but not semantic matching and that the semantic prefamiliarization factors affected semantic matching but not decoding. However, the semantic word factors affected both decoding and semantic matching, possibly as a result of final consonants and consonant clusters confounding semantic factors. (HOD)

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Phonological and Semantic Components of Words in Beginning Reading

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Is the process of reading isolated words comprised of two or three independent stages? That is, can the reading process be divided into separate stages where each stage is affected by a different set of factors?

It is hypothesized here that at least two independent stages comprise the process. The first stage is a decoding stage in which words are perceived and translated into an acoustic code. The second stage is a semantic matching stage in which words are matched with meaningful associations. It is assumed that the model can be tested by using correct pronunciation responses to measure decoding stage processing and "correct" meaningful associations to measure semantic matching stage processing.

The procedure for testing stage processing independence is a variation of one developed by Sternberg (1969). A set of stimulus factors are included in the experiment with the expectation that each will affect processing of one stage but not the other.

For this study, the words become the stimulus factors used to test the two-stage model. The words are categorized according to five factors. Three factors, to be called phonological factors, are expected to affect the decoding stage process only. Two factors, to be called semantic component factors are expected to affect the semantic matching stage only. All the stimulus word factors consist of two levels.

The phonological factors are word length, vowel complexity, and vowel regularity. The word length factor consists of four letter words and five letter words. The vowel complexity factor is a comparison of one vowel words (e.g., BLAND) with two vowel words (e.g., BROOK). The vowel regularity factor is a variation of major vowel sound patterns with minor vowel sound patterns (Venezky, 1970). For example, STICK, SLOOP, SPEAK are major patterns; BIRD, SOOT, BREAD are minor patterns.

The semantic component factors are word familiarity and word concreteness. The word familiarity factor is based on frequency of usage rankings (Kucera and Francis, 1967). That is, very common words are compared with rare or uncommon words. The concreteness factor is a comparison of nouns that have a real object reference (e.g., BIRD, DRESS) with abstract nouns, verbs, or adjectives (e.g., TRUTH, BALK).

Procedures for Experiments I and II

An experimental session consisted of 6 blocks, 96 words altogether. Each block had two phases, a prefamiliarization or training phase followed by a test phase. In the prefamiliarization phase, children were showed the words, were showed pictures describing the stimulus words, were read sentences in which the

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stimulus words appeared, or rehearsed the pronunciation of the unfamiliar words. In the test phase children were asked to pronounce each of the 16 words in the block then to give a meaningful association to each word. If they made a pronunciation error, they were corrected before giving an association.

There were minor procedural differences in Experiments I and II. In the prefamiliarizations given in phase one, one factor--showing pictures or showing words--was used in Experiment I. Two factors--one varying the sentences that were read and the other varying the amount of pronunciation practice--were used in Experiment II.

Experiment I was carried out with second and fifth grade children, Experiment II with first and third graders. The children were from a lower middle-class neighborhood in a large city. Forty-eight children were tested.

Results

An analysis of variance 9 factor mixed design was used to analyze the results. The results are summarized in Tables 1, 2, 3, and 4.

The results are largely consistent with the predictions of the model. In both experiments, the phonological prefamiliarization factors and phonological word factors affect decoding but not semantic matching. The semantic prefamiliarization factors affect semantic matching and not decoding. However, the semantic word factors affect both decoding and semantic matching.

Discussion

The analysis of variance findings strongly support the hypothesis that reading isolated words has at least two independent stages. decoding and semantic matching. The only results that do not support the two-stage model are the semantic word factors that affect decoding and semantic matching instead of semantic matching alone. The results from both experiments show that familiar or concrete words are easier to pronounce than are unfamiliar or nonconcrete words.

One possible explanation for the apparent violation of the stage processing model will be explored here, namely, that the semantic factors are confounded with uncontrolled orthographic factors.

An examination of the final consonants and consonant clusters of the words used in this study revealed systematic differences in the consonants typical to familiar and unfamiliar words and to the concrete and nonconcrete words. An analysis of error patterns revealed a tendency for errors to vary with these systematic differences, thus indicating a confounding between the semantic factors and a new factor, consonant cluster frequency.

To identify the confounding, final patterns of the 96 stimulus words were separated into three groups: 1) final consonant clusters that occur in more than 45 different monosyllabic English words (e.g., CH, ST, CK), 2) final consonant clusters that occur in less than 45 different words (e.g., LT, RF, LB), and 3) final patterns that do not contain a consonant cluster or that contain a doubled final consonant.

The final patterns in the words were then classified by the two semantic factors, familiarity and concreteness. This showed that consonant patterns are not evenly distributed among the word sets. Familiar words contain more of the common final consonant clusters while unfamiliar words contain more of the uncommon clusters. Concrete words tend to have a single final consonant while nonconcrete words have a consonant cluster.

Finally, a rank order correlational analysis was carried out between the ranked commonness of the final consonant clusters and the mean number of errors for each final cluster pattern. A significant correlation, .56 ($p > .02$) indicates that consonant cluster frequency and final consonant error frequency are related. Common consonant clusters tend to generate the fewest consonant cluster errors. Rare consonant clusters tend to generate the greatest number of errors.

This analysis shows that semantic factors are confounded by the commonness of the final consonant patterns. It shows also that a consonant cluster frequency factor contributes to the decoding errors presently attributed to the semantic factors. It is possible that if consonant frequency can be separated from familiarity and concreteness, the semantic factors will no longer affect decoding. If that is true, a stage processing model for reading isolated words can be fully supported.

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Table 1

Pronunciation Error Analysis, Experiment 1

Source	Level	Mean	df	F ratio	Significance Level
Between Subjects Factors					
Grade	gr 2	.316	1,20	$\frac{27.1}{1.8} = 14.4$	.01
	gr 5	.099			
Grade x	gr 2, 1 vowel	.252	1,20	$\frac{1.00}{.14} = 7.0$	.05
# Vowels	gr 2, 2 vowel	.380			
	gr 5, 1 vowel	.176			
	gr 5, 2 vowel	.122			
Sex x	girls, 1 vowel	.124	1,20	$\frac{.92}{.14} = 6.4$	.05
# Vowels	girls, 2 vowel	.250			
	boys, 1 vowel	.205			
	boys, 2 vowel	.251			
Within Subjects Factors					
Word Familiarity	familiar words	.115	1,20	$\frac{19.5}{.68} = 28.7$	.001
	unfamiliar	.299			
Word Concreteness	concrete	.192	1,20	$\frac{.56}{.07} = 8.3$	.01
	nonconcrete	.223			
Vowel Complexity	1 vowel	.164	1,20	$\frac{4.3}{.14} = 30.2$	.001
	vowel digraphs or diphthongs	.251			.001
Vowel Regularity	major pattern	.184	1,20	$\frac{1.3}{.12} = 11.3$	.01
	minor pattern	.231			
Familiarity x Vowel Complexity	fam, 1 vowel	.120	1,20	$\frac{5.3}{.07} = 79.8$	.001
	fam, 2 vowel	.112			
	unfam, 1 vowel	.219			
	unfam, 2 vowel	.391			
Prefamiliarization	pictures	.221	1,20	$\frac{.44}{.18} = 3.2$	.10
	words	.194			

Table 2

Association Error Analysis, Experiment 1

Source	Level	Mean	df	F ratio	Significance Level
Paradigmatic Association Error Analysis					
Grade	gr 2	.832	1,20	$\frac{1.9}{.37} = 5.3$	.05
	gr 5	.774			
Grade x sex	gr 2 girls	.817	1,20	$\frac{3.6}{.37} = 9.7$	.01
	gr 5 girls	.828			
	gr 2 boys	.858			
	gr 5 boys	.720			
Within Subjects Factors					
Word Familiarity	familiar	.727	1,20	$\frac{13.3}{.24} = 54.9$	.001
	unfamiliar	.879			
Word Concreteness	concrete	.769	1,20	$\frac{2.7}{.18} = 15.2$	.001
	nonconcrete	.838			
Prefamiliarization	pictures	.769	1,20	$\frac{2.7}{.266} = 11.9$	.01
	words	.838			
Syntactic Association Error Analysis					
Word Familiarity	familiar	.637	1,20	$\frac{25.8}{.18} = 141.4$	.001
	unfamiliar	.849			

Table 3

Pronunciation Error Analysis, Experiment 2

Source	Level	Mean	df	F ratio	Significance Level
Between Subjects Factors					
Grade	gr 1	.269	1,20	$\frac{17.89}{1.75} = 10.2$	.01
	gr 3	.093			
Within Subjects Factors					
Word rehearsal prefamiliarization	rehearsal	.157	1,20	$\frac{1.31}{.23} = 5.8$	.05
	no rehearsal	.205			
Word rehearsal prefamiliarization x familiarity	fam, rehearsal	.139	1,20	$\frac{3.9}{.20} = 19.1$	.001
	fam, no rehearsal	.100			
	unfam, rehearsal	.175			
	unfam, no rehearsal	.306			
word familiarity	familiar	.122	1,20	$\frac{8.15}{.14} = 58.02$	.001
	unfamiliar	.240			
word concreteness	concrete	.167	1,20	$\frac{.66}{.06} = 11.2$	.01
	nonconcrete	.198			
vowel complexity	1 vowel	.137	1,20	$\frac{4.4}{.24} = 18.2$	.001
	2 vowel	.225			
vowel regularity	major pattern	.148	1,20	$\frac{2.57}{.05} = 51.67$	.001
	minor pattern	.214			
familiarity x vowel complexity	fam, 1 vowel	.101	1,20	$\frac{1.22}{.18} = 6.8$	.05
	fam, 2 vowel	.142			
	unfam, 1 vowel	.174			
	unfam, 2 vowel	.308			
word length x vowel complexity	4 letter, 1 vowel	.140	1,20	$\frac{1.13}{.065} = 17.2$	.001
	4 letter, 2 vowel	.185			
	5 letter, 1 vowel	.135			
	5 letter, 2 vowel	.263			

Table 4

Association Error Analysis, Experiment 2

Paradigmatic association analysis

Source	Level	Mean	df	F ratio	Significance Level
Between Subjects Factors					
Grade	gr 1	.788	1,20	$\frac{20.25}{2.2} = 9.1$	.01
	gr 3	.501			
Sex x Familiarity	girls, fam. word	.405	1,20	$\frac{5.8}{.61} = 9.5$	.01
	girls, unfam. word	.810			
	boys, fam. word	.485			
	boys, unfam. word	.685			
Within Subjects Factors					
word meaning prefamiliarization	paradigmatic assoc.	.540	1,20	$\frac{2.30}{.40} = 5.8$	.01
	sent. + parad. assoc.	.594			
	sent. w/out parad. assoc.	.650			
word familiarity	familiar word	.445	1,20	$\frac{51.9}{.61} = 84.9$	.001
	unfamiliar word	.745			
word concreteness	concrete word	.529	1,20	$\frac{10.03}{.27} = 37.1$	.001
	nonconcrete word	.661			
familiarity x vowel complexity x vowel regularity	major, 1 vowel familiar	.480	1,20	$\frac{5.6}{.07} = 78.7$	.001
	minor, 1 vowel familiar	.375			
	major, 1 vowel unfam.	.650			
	minor, 1 vowel unfam.	.785			
	major, 2 vowel familiar	.424			
	minor, 2 vowel familiar	.500			
	major, 2 vowel unfam.	.813			
	minor, 2 vowel unfam.	.740			